

REMARKS

This Amendment is filed in response to the Office Action dated December 30, 2003. Applicants initially note with appreciation the Examiner's thorough examination of the application as evidenced by the Office Action. In response to the Office Action, Applicants have amended Claims 1, 3, 7, and 13 and added new Claims 16-19. The claims were amended so as to more clearly define the claimed invention. Applicant respectfully submits that the amended and newly added claims are in condition for allowance and asks that the Examiner reconsider the claims in light of the remarks below.

I. Objected Claims

On page 1, the Office Action objects to Claim 7 for use of the term "the said." Applicants have amended Claim 7 by deleting "the" such that the phrase now reads "said." In reviewing the claims, Applicants noted that similar issues occur in Claims 1 and 13. Applicants have also corrected these claims. Applicants respectfully submit that the objection is now overcome.

II. The Claims Are Patentable

On page 1, the Office Action rejects Claims 1, 2, 5, 7-10, 12, and 13 as anticipated by U.S. Patent No. 5,422,670 to Fukui. Further, the Office Action rejects the remaining claims, 3, 4, 6, 11, 14, and 15 as obvious in light of the '670 Fukui patent in combination with one or more of the following references: U.S. Patent No. 6,218,656 to Guidas and U.S. Patent No. 5,422,716 to Dempsey. Applicants respectfully disagree with these rejections as detailed below.

In particular, Applicants submit that the cited references nowhere teach or suggest the recitation that the image sensor is regularly reset so as to commence integration from a reset state of the sensor each time a predetermined period has elapsed as is recited in independent Claims 1, 3, 7, and 13 of the present invention. Specifically, Applicants argue that the system of the '670 Fukui patent continuously resets the imager, which is released only when an external detector senses the object and triggers the image capture.

In the '670 Fukui patent, the trigger pulse issued by the position sensor 23 upon detecting movement of the object 22 ceases the supply of reset pulses to the sensor. These reset pulses are effectively continuously sent to the sensor, prior to generation of this trigger pulse. The detector trigger pulse, in fact, causes a "shutter pulse" to be generated (see '670 Fukui col. 1, lines 49-54). The shutter pulse ceases the continuous supply of reset pulses to the sensor, thereby initiating the charge storage period of the sensor (see '670 Fukui col. 2, lines 1-2 and col. 7, lines 14-18), i.e., the sensor only starts integrating charges when the shutter pulse has triggered. As specified at '670 Fukui col. 1, lines 31-34, "no electrical charges are stored in the CCD image are supplied" (making reference to Fig. 1C). The charge storage period ends when a read-out pulse is received by the sensor. At the end of the charge storage period the reset pulses are again continuously applied to the sensor (see '670 Fukui col. 5, lines 36-38).

In contrast, in the claimed invention of Claims 1, 3, 7, and 13 of the present application the sensor starts integrating immediately after each regular reset pulse and if the detector detects the occurrence of an asynchronous stimulus, the next reset pulse is inhibited. Thus, the sensor merely continues integrating for longer than would otherwise have been the case if that (inhibited) reset pulse had been applied. This is illustrated more clearly in Figs. 3a-3c. This difference between the systems of the '670 Fukui patent and the present invention is also clearly illustrated by comparing Fig. 3a of the present application with Figs. 1a-1c of the '670 Fukui patent. As seen from Fig. 1c of the '670 Fukui patent, the sensor of the '670 Fukui patent is most of the time in its charge drain period. When it is effectively in continuous reset, the charge storage time in its charge drain period, when it is effectively in continuous reset, the charge storage time occurring during the smaller periods when reset pulses cease to be applied. In contrast, as illustrated clearly in Fig. 3a of the present application, the sensor is integrating charges between each reset pulse. It will thus be appreciated that amended claim is neither taught nor suggested by the cited references.

Moreover, the sensor system of the '670 Fukui patent is designed specifically for capturing images of fast moving objects. This is emphasized throughout the entire "background of the invention" section in columns 1-3 of the '670 Fukui patent. In order to capture the fast moving object, it is necessary to detect the movement of the object using a position sensor 23.

When the position sensor detects the moving object, it issues a trigger pulse, which controls the integration period of the sensor. The '670 Fukui patent refers to this operation as, in effect, controlling the shutter speed of the imaging device, i.e., the position sensor 23 and trigger pulse issued therefrom are used to provide an electronic shutter function for capturing an image of the moving object. Consequently, there is no physical shutter present (see Figs. 2 and 4 of the '670 Fukui patent).

This is entirely different to the present invention, which is designed for operation with an imaging system in which exposure is controlled by an asynchronous stimulus such as lighting strobe or shutter opening action. An image to be captured is presented to the sensor detector, which may be separate from the sensor or which may in fact be a portion of the sensor array, the detector is used to detect the asynchronous stimulus, not to detect any feature of the image which is actually presented to the sensor.

It will be noted, in the present invention, no detector signal is used to commence an integration period of the sensor of the present invention. As will be appreciated from Figs. 3a and 3b, an integration period of (Tr) will normally already have started prior to detection of an asynchronous stimulus and is merely then continued (Tc) by inhibiting the next reset pulse which was due to be applied to the sensor. A main advantage of this difference between the present invention and the system of the '670 Fukui patent is that in the present invention the delay time (Td) between occurrences of the stimulus and the detector actually triggering does not affect the charge integration period (Te3) of the sensor during the occurrence of the stimulus. In most scenarios (see Figs. 3a and 3b), the sensor is thus integrating over the full period of the stimulus S, unlike the prior art situation illustrated in Fig. 2a and unlike in the system of the '670 Fukui patent, in which the charge integration period only starts upon receipt of the shutter pulse triggered by the detector trigger pulse. The delay between the position sensor 23 sensing the moving object 22 in the '670 Fukui patent, and subsequently issuing the detector trigger pulse is thus mirrored in the charge integration period of the '670 Fukui sensor.

Moreover, as discussed above, in the '670 Fukui sensor, prior to receipt of the shutter pulse reset, pulses are being continuously sent to the image sensor 7 so that the sensor is effectively in a state of continuous reset.

With reference to independent Claim 3 of the present application, the difference between the claimed method and the '670 Fukui patent is also clear, since in Claim 3, a portion of the array of the image sensor itself is read prior to each regular reset operation, i.e., no separate detector is provided. If the value of this read indicates the occurrence of an asynchronous stimulus, then the subsequent reset signal to the sensor is inhibited. It will be appreciated that this operation would be impossible in the sensor device of the '670 Fukui patent, since it is effectively in a continuous state of reset, with no charges being accumulated. Thus, it would be impossible in the '670 Fukui patent to try to detect movement of an object in the image which is being presented to the sensor. Therefore, there would be no reason for one skilled in the art to look to the other references to fix the defects of the '670 Fukui patent.

Applicants would also like to draw the Examiner's attention to dependent Claims 16-19, which recite that the image sensor is performing integration during the predetermined period. This feature is patentable over the cited references. As stated above, the sensor of the '670 Fukui patent only starts integrating charges when the shutter pulse has triggered. It does not integrate during the period that it is continuously reset.

Conclusion

In view of the amended and added claims and remarks presented above, it is respectfully submitted that all of the present claims of the application are in condition for immediate allowance. It is therefore respectfully requested that a Notice of Allowance be issued. The Examiner is encouraged to contact Applicants' undersigned attorney to resolve any remaining issues in order to expedite examination of the present application.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required

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therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,



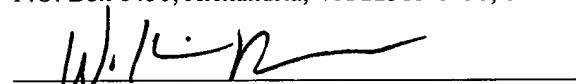
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